17-708 SOFTWARE PRODUCT LINES: CONCEPTS AND IMPLEMENTATION

PRODUCT MANAGEMENT AND SCOPING

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Sections 1-4

Try to understand example, incl. notation and composition
LEARNING GOALS

Costs of variability
Strategic function of variability management
Basic considerations of scoping
"process of identifying and bounding areas (subdomains, existing assets) and capabilities (features) of the product line where investment into reuse is economically useful and beneficial to product development."

– M. Becker. Fraun.IESE
SCOPING

Too broad: unnecessary effort
Too small: lack of reuse, lack of flexibility

Scope considerations

Marketing has to know/sell supported features
Management needs to know scope and evolve it
Engineers realize it
QA within the entire scope

**Figure 1: PuLSE-Eco V2.0 Components**

- Product Portfolio, Existing Systems, Product plans
  - Expert knowledge; Organizational Structure
- Product Line Mapping (PLM)
  - high-level description of: product line, domains, features, and their relationships
- Domain Potential Assessment (DPA)
  - assessment of potential reuse benefits and risks; domain selection
- Reuse Infrastructure Scoping (RIS)
  - assets for reuse infrastructure identified (asset scope)
<table>
<thead>
<tr>
<th>Domain 2</th>
<th>Domain 1</th>
<th>exist.</th>
<th>planned</th>
<th>potent.</th>
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</thead>
<tbody>
<tr>
<td>Sub-Domain 2.1</td>
<td>Feature 2.1.1</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
| ... | ... | ... | ... | ... | ...
| ... | ... | ... | ... | ... | ...
| ... | Feature m.1.1 | - | X | - | X |

Table 1. Initial Product Map

Figure 3: Assessment Process

Preparation

- Pre-assessment meeting
- Initialization
- Assessment Team Identification
- Planning and scheduling
- PL-mapping (Prestudy)

Execution

- Opening Briefing
- Domain Assessment
- Preliminary Results
- Interviewee feedback

Analysis

- Final Report Preparation
- On-site final meeting

Figure 4: Assessment Evaluation Dimensions

Viability dimensions
- Maturity
- Stability
- Resource constraints
- Organizational constraints

Benefit dimensions
- Market potential – External
- Market potential – Internal
- Commonality and Variability
- Coupling and Cohesion
- Existing Assets
### Products

High Benefit from reuse

Small Benefit

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Products</th>
<th>High Benefit from reuse</th>
<th>Small Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighted result</td>
<td>p(w) = p(v) * p(h)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic product selection class 1</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Manual product selection class 1</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Automatic product selection class 2</td>
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<td>Yes</td>
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<tr>
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<tr>
<td>Automatic product selection class 3</td>
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<tr>
<td>Manual product selection class 3</td>
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</tbody>
</table>

| Product Map extern | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}" | "\text{H}\)
MASS CUSTOMIZATION IN CAR PRODUCTION

30 years ago

Little variability
A single variant creating 40% of all profit

15 years ago

$10^{20}$ configurations at Audi
$10^{32}$ configurations at BMW
Rarely two identical configurations produced
100 different undercarriages
50 different steering wheels
PROBLEMS IN CAR MANUFACTURING

High number of variations caused complexity and costs

- Logistics
- Development
- Investment in machines and tools
- High production costs due to small scale manufacturing

"But we need variability to satisfy customer demands"

Variability management as strategic project; include developers, logistics experts, and marketing
VARIABILITY MANAGEMENT IN CAR PRODUCTION

Analyze demand (which features, in which combinations)

   Eliminate rare variants

"We should not develop and product parts that we are not using"

Consider variability reduction during development

   Audi saved 5 million Euro by designing the central button panel in the roof interior in a neutral color

   BMW reduced the number of (all invisible) undercarriage variants from 100 to 4 (left/right steering, with/without sunroof)

   Bundling of options into packages
COSTS PER FEATURE

Research and Development Cost
Maintenance Costs, Testing, Support
Interactions
Today's weather: [:weather: 🌞]
FURTHER READING


Prof. Dr. Klaus Pohl, Dr. Günter Böckle, Dr. Frank van der Linden. Software Product Line Engineering. Chapter Product Management. Springer 2005
